

INTRODUCTION

It is difficult, indeed, almost an impossible task, to publish a comprehensive catalog of the various types of optical and mechanical instrumentation we are able to furnish. For the past 30 years, we have been supplying research and development laboratories in the U.S. as well as abroad. We have endeavored to have available the best and most up-to-date facilities for the manufacture and testing of our products and maintain a staff of highly skilled personnel.

Experience has shown that the compilation of a standard catalog, particularly for optic parts, accomplishes very little, for each research project has its own special requirements. It has been found that it is actually cheaper to produce the item to the specifications of the researcher rather than maintain huge stocks and offer a substitute. Instruments or optical systems that may be acceptable today may become obsolete, or at least second best, in the near future.

Whenever possible, we welcome personal visits for a direct discussion of the problem at hand. At such time, your inspection of our facilities is invited.

Terms

ALL PRICES QUOTED ON REQUEST

The specifications contained herein were in effect at the time this literature was approved for printing. The John Unertl Optical Company, whose policy is one of continuous improvement, reserves the right, however, to change specifications or design at any time without notice and without incurring obligations.

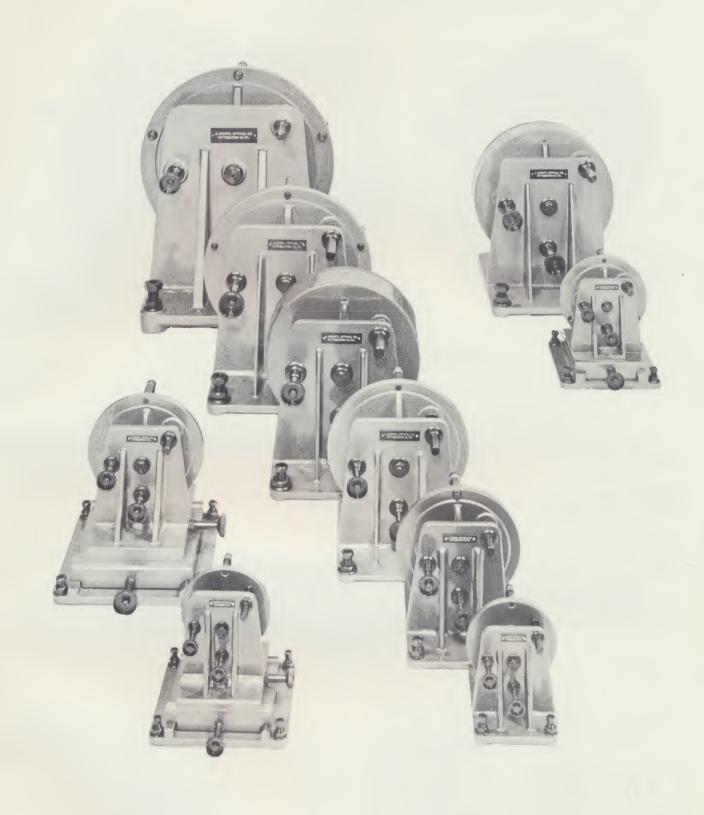
Our products are guaranteed optically and mechanically to meet performance specifications.

Contents

	Page
Plain Base Mirror Mounts	6
Mirror Mounts—Table Type	7
Mirror Mounts—Axial Focus Type	
Mirror Mounts—Dual Slide Type	
Large Schlieren or Shadowgraph Mirror Mountings	
Interferometer Mounts	
Piers	13
Folding Mirror Mounts	14
Adjustable Height Folding Mirror Mounts	
BH-6 Normal & Color Schlieren Source	
Schlieren Sources—Plain Type	18
Power Supplies	19
Schlieren Knife Edge Units	20
Electric Drive Knife Edges	21
Slits	22
Condenser & Relay Systems	22
Micrometer Slides	23
Cassegrain Systems	
Optical Benches & Accessories	24-25
Self Centering Chucks	25
Schlieren Recording Systems	26
Schlieren Camera	
Packaged Schlieren Systems	28
Split Bridge Schlieren Systems	29
20" U.S. Naval Ordnance Laboratory Schlieren System	
Autocollimating Shadowgraph	31
10" Mach-Zehnder Interferometer	31
Grating Mounting	
Fabry-Perot Interferometers	
Optical Testing Instrumentation	
Tri-Ordinate Slides	
Light Pulse Generator	34
Viewing and Alignment Telescopes	34
Schlieren Optics	
Mirrors, Lenses & Prisms	
Conclusion	36

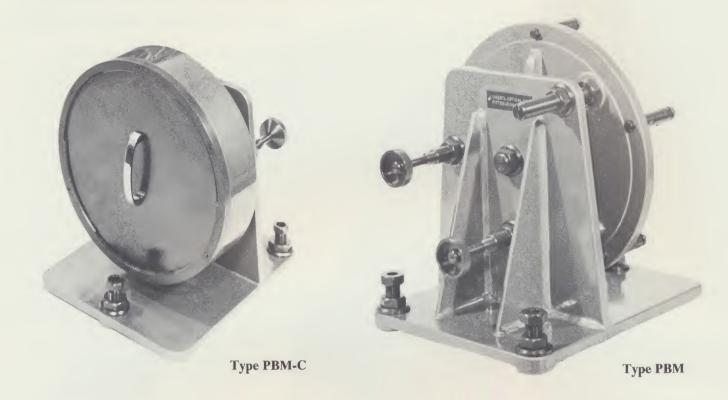


Flow Visualization Instrumentation



Telephone 321-2215 (Area Code 412)

PLAIN BASE MIRROR MOUNTS



These mirror mounts are designed for the mounting and precise positioning of front surface mirrors and are furnished in either the open or cell type construction.

The mounts are provided with independent angular adjustment in the vertical and horizontal planes and have a minimum angular travel of 8° from normal position. The adjustments are made by precision screws, handwheel operated, driving against the spring preloaded mirror backing plate.

In the open type, the mirror is supported by two Micarta faced pads and it is airspaced from the backing disc by three similarly faced pads. Clips retain the mirror in proper position. In the cell type, mirror is retained peripherally by three Micarta pads, and is axially positioned by the face bayonet ring for the dust cap and sponge rubber pad within the cell. Both types are designed to hold mirrors having a thickness of about 1/6 the mirror diameter.

The base has three leveling screws with locking nuts which are drilled and countersunk to accommodate Allen type cap screws for attaching to the support or pier. These mounts may be mounted in any position required. Finish is light gray Hammertone with operational controls blackened.

Open Type		Cell Type	
Cat. No.	Disc Size	Cat. No.	Aperture
PBM-4	4''	PBM-4C	3-13/16"
PBM-6	6''	PBM-6C	5-3/4"
PBM-8	8"	PBM-8C	7-3/4"
PBM-10	10"	PBM-10C	9-3/4"
PBM-12	12"	PBM-12C	11-3/4"
PBM-16	16"	PBM-16C	15-3/4"
PBM-18	18"	PBM-18C	17-3/4"
PBM-20	20"	PBM-20C	19-3/4"
PBM-22	22"	PBM-22C	21-3/4"
PBM-24	24"	PBM-24C	23-3/4"
PBM-30	30"	PBM-30C	29-3/4"

Intermediate sizes quoted upon request

MIRROR MOUNTS - TABLE TYPE





Type TTM

This series of mounts is intended for general laboratory use where they will be frequently moved about rather than for a fixed installation.

The mirror is cell mounted similar to our other mounts and is provided with a bayonet dust cover. Normally the rear side of the cell is solid but it can be perforated if so required.

The horizontal and vertical spindles are mounted on preloaded ball bearings and the cell can be rotated 360° in both planes and clamped in any position. When so locked by the tangent arm, $a \pm 5^{\circ}$ angular motion by means of a preloaded handwheel driven precision screw is engaged. Finish is a light gray Hammertone with the operational controls blackened.

These mounts are supplied less mirror or complete with a plane, parabolic or spherical mirror. All mirrors so supplied will have a surface accuracy of 1/2 wave mercury green light with an aluminum and silicon monoxide overcoated reflecting surface. The standard material for mirrors is Pyrex glass. Higher accuracies and other mirror materials will be quoted upon request.

Cat. No.	Aperture
TTM-6	5-3/4"
TTM-8	7-3/4"
TTM-10	9-3/4"
TTM-12	11-3/4"
TTM-16	15-3/4"
TTM-20	19-3/4"
TTM-24	23-3/4"

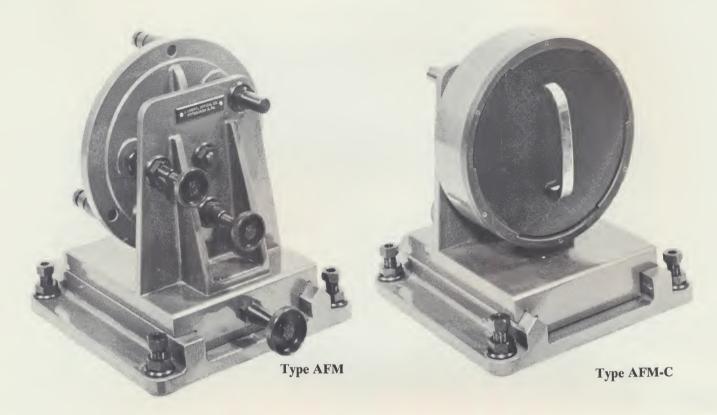
When mountings are to be supplied with mirrors, use the following suffix designations:

F—Plane mirror

P—Parabolic mirror, f/8 unless otherwise specified

S—Spherical mirror, f/8 unless otherwise specified

MIRROR MOUNTS - AXIAL FOCUS TYPE



The axial focus type mirror mount is often required in an optical or Schlieren system where it is inconvenient to displace other apparatus of the system to make the necessary focusing adjustments.

These mirror mounts are supplied in the same size range as the plain type. General constructional and operational features are identical and differ only in that a V-flat design base is added to give an axial motion. A micrometer screw, handwheel operated, drives the upper assembly. The base plate is provided with four leveling screws with lock nuts which are drilled and countersunk to accommodate Allen type mounting screws.

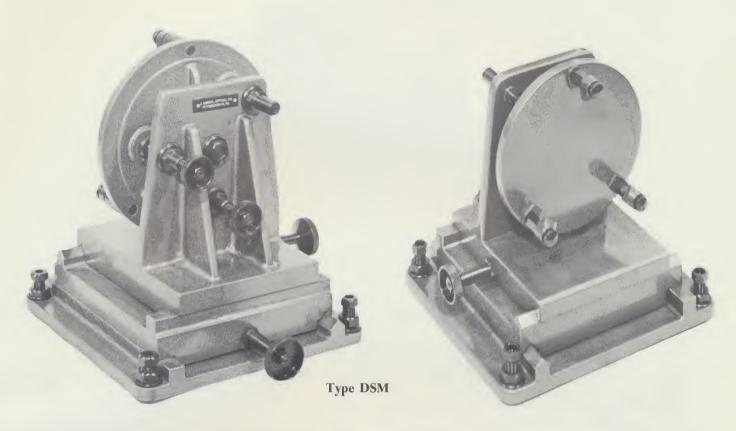
The axial focus type mounts are furnished in either the open or cell type construction.

Finish is light gray Hammertone with operational parts blackened.

Open Type		Cell	Туре
Cat. No.	Disc Size	Cat. No.	Aperture
AFM-4	4"	AFM-4C	3-13/16"
AFM-6	6"	AFM-6C	5-3/4"
AFM-8	8"	AFM-8C	7-3/4"
AFM-10	10′′	AFM-10C	9-3/4"
AFM-12	12′′	AFM-12C	11-3/4"
AFM-16	16"	AFM-16C	15-3/4"
AFM-18	18"	AFM-18C	17-3/4"
AFM-20	20′′	AFM-20C	19-3/4"
AFM-22	22"	AFM-22C	21-3/4"
AFM-24	24"	AFM-24C	23-3/4"
AFM-30	30"	AFM-30C	29-3/4"

Intermediate sizes quoted upon request

MIRROR MOUNTS - DUAL SLIDE TYPE



This type of mirror mounting has the standard form of angular adjustments. The coordinate base of V-flat design gives a screw operated adjustment axially and transverse to the optical axis. It is extremely useful for positioning off-axis mirror optics.

The mount is furnished in either cell or open type and up to 30" mirror disc sizes. Finish is a light gray Hammertone with operational controls blackened.

Open Type		Cell Type		
Cat. No.	Disc Size	Cat. No.	Aperture	
DSM-4	4"	DSM-4C	3-13/16"	
DSM-6	6"	DSM-6C	5-3/4"	
DSM-8	8"	DSM-8C	7-3/4"	
DSM-10	10′′	DSM-10C	9-3/4"	
DSM-12	12"	DSM-12C	11-3/4"	
DSM-16	16"	DSM-16C	15-3/4"	
DSM-18	18"	DSM-18C	17-3/4"	
DSM-20	20"	DSM-20C	19-3/4"	
DSM-22	22′′	DSM-22C	21-3/4"	
DSM-24	24"	DSM-24C	23-3/4"	
DSM-30	30′′	DSM-30C	29-3/4"	

Intermediate sizes quoted upon request

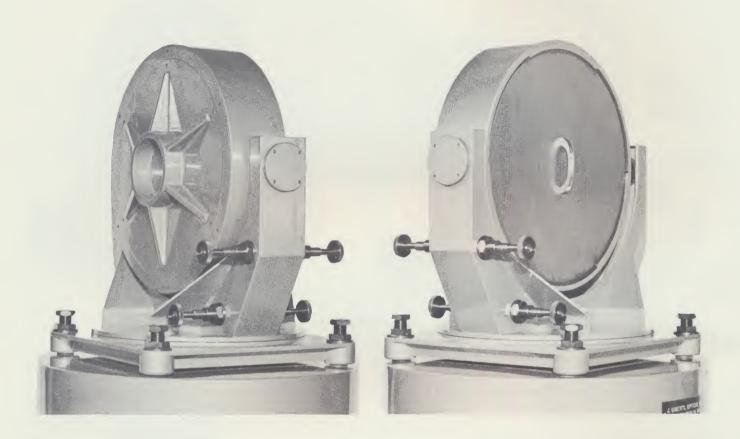
SPECIAL MOUNTINGS

In such instances where mirror mountings are required which cannot be fulfilled by our standard catalog lines, we are prepared to supply mountings designed for specific applications.

Examples of such mounts are plain back, overhead or side mounting surface types for attaching to a building or system structure, transversing base mounts for scanning systems, or with adjustable height using manual, electric or hydraulic drive.

We invite your inquiries for such specialized applications.

Large Schlieren or Shadowgraph Mirror Mountings



Type YMM-C

Mirror mountings of this design are for use with Schlieren or Shadowgraph mirrors of 16" diameter or larger. All trunnions are anti-friction mounted. Independent angular adjustments in both planes are by handwheel driven precision screws operating in push-pull manner. The center of rotation of either angular motion is coincident with the center of the mirror surface to eliminate changes in focus.

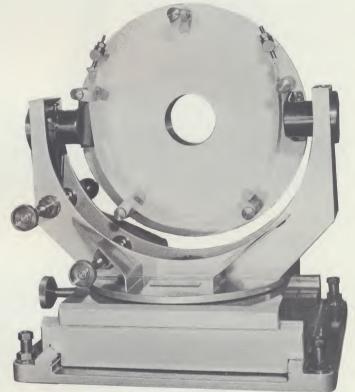
These mountings are furnished in either open or cell type construction. In the open form, the mirror disc is supported by a stainless steel canvas faced strap so as to eliminate any mounting stresses. The disc is airspaced from the backing plate by three Micarta faced pads and axially retained by clips. Backing disc can be locked in horizontal position for mounting the mirror. For the cell type, the mirror is retained peripherally by Micarta pads and also an internal strap assembly similar to the open type. A bayonet dust cover is provided and the back ribbed cover of the cell housing is removable to permit insertion of the disc. A neoprene rubber faced ring, driven by screws in the back plate, axially positions the mirror against the cell flange. The rear cover is normally solid on the cell type but can be supplied perforated for use with Cassegrain or Pfund systems.

These mountings can be furnished with axial focus or coordinate slide bases. The mountings are also available in demountable form which permits the removal of the entire cell assembly from the yoke, and a single cell with mirror can be used on a number of yokes. For such use, all adjustment screws are calibrated to facilitate accurate and repetitive setting. In instances where adjustments must be made in the arc second range, we offer a dual speed tangent drive. The normal screw adjustment is coupled with an overrunning secondary drive which gives an equivalent screw pitch of 20 times as fine as standard. Higher ratios are also available. The use of the dual speed drive does not reduce the normal range of angular adjustment. Multiple position and electric drives can also be furnished.

Both open and cell types are designed to accommodate mirrors having a thickness of 1/6 the mirror diameter.



Type YMM-C with Dual Speed Tangent Drive

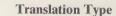


Type YMM with Dual Slide Base

Open Type		Cell Type		
Cat. No.	Disc Size	Cat. No.	Aperture	
YMM-16	16"	YMM-16C	15-3/4"	
YMM-18	18"	YMM-18C	17-3/4"	
YMM-20	20′′	YMM-20C	19-3/4"	
YMM-24	24′′	YMM-24C	23-3/4"	
YMM-30	30′′	YMM-30C	29-3/4"	
YMM-36	36′′	YMM-36C	35-3/4"	
YMM-40	40′′	YMM-40C	39-3/4"	
YMM-48	48′′	YMM-48C	47-3/4"	
YMM-60	60′′	YMM-60C	59-3/4"	
YMM-72	72′′	YMM-72C	71-3/4"	

INTERFEROMETER MOUNTS

Plain Type







We manufacture two types of mountings which are specifically designed for interferometric systems.

In the Mach-Zehnder form, usually three plain type mounts are used for the two beam splitter plates and for one of the end reflector mirrors, and the translation type is used for the remaining end reflector mirror so that the path length can be equalized. Similarly, in the Twyman-Green form, two of the plain type are used for the one end reflector and the beam splitter and the translation form for the second end reflector. The models shown are for a system which has the optical axis in the vertical plane, but can be supplied for the more commonly used horizontal construction.

In either type, the axis of the angular rotation is on the plane of the reflecting or beam splitting surface. Angular and axial movements are semi-kinematically mounted on ball bearings and preloaded so that the highest accuracy and sensitivity in response to minute adjustment can be made. The tangent arms are driven by precision screws which are manually or electrically operated. Electric drive is suggested particularly for the Mach-Zehnder form since all controls can be grouped at a common location. It is then possible to make accurate adjustments to each element while observing the fringe pattern.

Plain Type		Translation Type	
Cat. No.	Disc Size	Cat. No.	Disc Size
IMP-6	6''	IMT-6	6"
IMP-8	8"	IMT-8	8"
IMP-10	10"	IMT-10	10′′
IMP-12	12"	IMT-12	12"
IMP-16	16"	IMT-16	16''
IMP-18	18"	IMT-18	18''
IMP-20	20"	IMT-20	20′′
IMP-22	22"	IMT-22	22"
IMP-24	24"	IMT-24	24''
IMP-30	30"	IMT-30	30′′

After mount size, use suffix "M" for manual drive and "E" for electric.



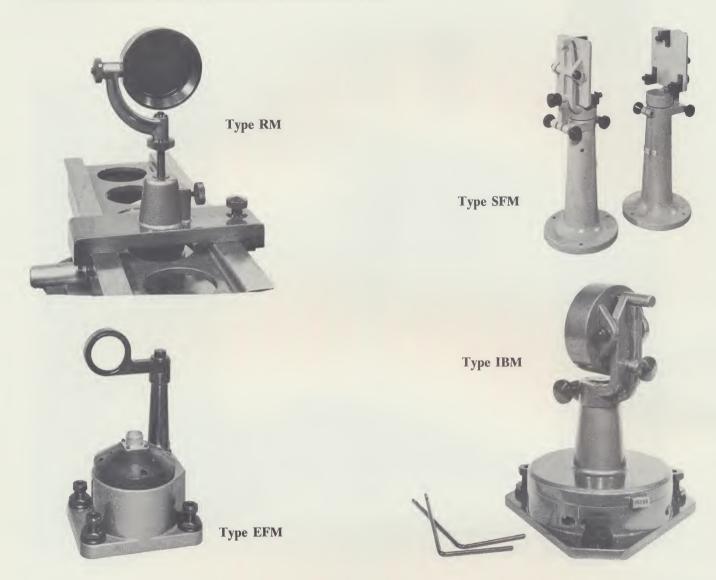


These piers are designed to be used with our mirror mountings or similar apparatus. They are fabricated steel weldments and have a hole in the upper flange for partial sand filling of the column. The base has three square head leveling bolts with lock nuts, and there are three casters mounted inside the hexagonal base. When the leveling screws are backed off, pier with attendant apparatus can be rolled about. Upper flange is drilled and tapped when ordered with mirror mounts. In the larger sizes, these piers can be furnished with a door and internal shelves for storage, or with a hinged panel for housing electrical controls or power supplies. Finish is a baked, light gray Hammertone.

Cat. No.	Column Dia.	Plain Base Mirror Mount Size
P-10	10"	4" & 6"
P-12	12"	8"
P-16	16"	10′′
P-19	19"	12''
P-25	25"	16"
P-36	36"	24''

Column height is measured from floor line to upper flange. Intermediate sizes, square, rectangular or special cross sections made to order.

FOLDING MIRROR MOUNTS



These mirror mounts are designed for use in Schlieren Systems to hold small plane front surface folding mirrors. All types have provisions for angular adjustments in the vertical and horizontal planes.

Type RM is generally used in conjunction with an optical bench and does not have screw adjustments for angular motion.

Type EFM is an electrically operated "flip" mirror mounting. A rotary solenoid, coupled by gearing drives the vertical shaft which carries the mirror. Angular travel is normally 45° and the relative position of the mirror to the base is infinitely phaseable by simply loosening the four clamping screws in the drive solenoid retainer ring. A positive stop allows accurate registry and repetitive positioning. Base to optical axis and mirror size must be specified when ordering.

Type SFM has independent screw driven adjustments for angular motion in both planes of about 8° travel, and the upper head assembly can be rotated 360° with respect to the flanged base. Cell type mounting is used for circular mirrors and the open airspace form for square or rectangular mirrors.

Type IBM is similar to the above except that the plain column is replaced by a base in which are housed four individually adjustable index positions. Application is to enable the selection of any one of two sources which are located at right angles to the normal optical axis. This feature is particularly useful on systems using spark or pulsed sources and which still require a means of steady state illumination for alignment purposes.

Folding mirror mounts of these designs are available to hold mirrors of from 1" round, true elliptical, square or rectangular forms up to 8".

Price quotation and outline drawings upon request.

ADJUSTABLE HEIGHT FOLDING MIRROR MOUNTS





Plain Base Adjustable Height Mount



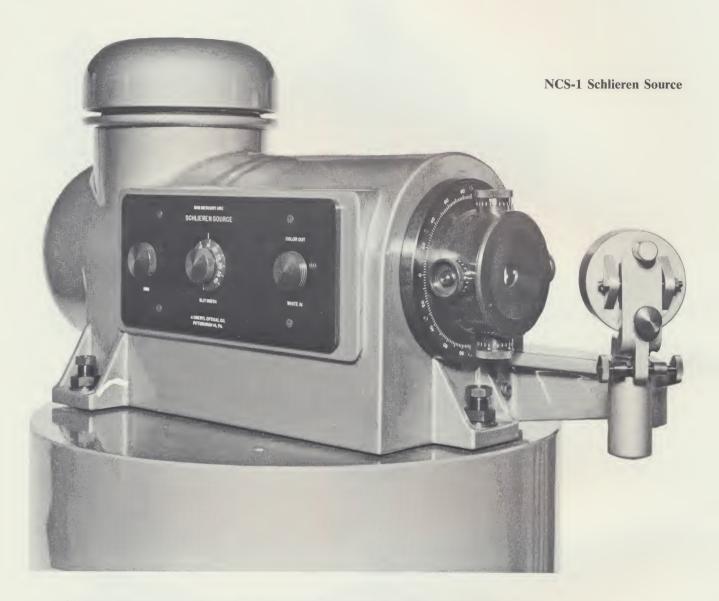


Indexing Base Adjustable Height Mount

A variation of the more commonly used folding mirror mounts illustrated on the previous page, these mountings have provisions for adjustment of the optical center line height.

Similarly, any of the standard folding mirror mounts can be mounted on a micrometer slide sub base for accurate positioning by screw adjustments.

BH-6 NORMAL & COLOR SCHLIEREN SOURCE



This type of source enables the selective presentation of normal or color Schlieren flow visualization.

The unit consists of an exterior housing in which axially slides a keyed bridge structure carrying the source, optical system, control panel and head assembly. Axial focus is by means of the graduated dial at the rear of the domed portion.

The dome is removable to give access to the BH-6 lamp holder, and is suitably baffled to prevent stray radiation while still permitting adequate ventilation.

Entrance aperture to the Schlieren system is the slit head which can be rotated 360°. This assembly drives by means of planetary gearing a Pechan prism which rotates the image of the horizontally mounted BH-6 so that it is in synchronism with the slit irrespective of angular orientation.

When used for white light illumination, the prism selector table is in the open position of a collimated beam; and for color, any of the three other available positions introduce into this section Amici prisms of various angular dispersions. Prisms are designed for zero deviation of the mercury green line. The optical system operates at f/6 and will illuminate systems of this speed or slower.

A folding mirror mount permits latitude in the positioning of the source and reduces to a minimum the required off axis angle at which the Schlieren collimating mirror operates.



NS-1 Schlieren Source



Dual Source Type

A variation of this source is an electromagnetically operated lamp holder which enables the use of a second lamp. If the BH-6 is used for steady state illumination, the second lamp could be the FX-12 Xenon arc lamp arranged for pulse illumination. Accurate registry by adjustable stops allows switching of sources without any further adjustment to the Schlieren system. When ordered with the required power supplies, the selection of a source automatically switches to the proper power supply.

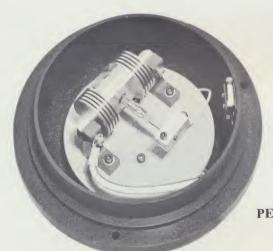
A pier, with door which is used as the electrical control panel, can be supplied to house the required power supply, airline controls and service feeders.

Cat. No.	Description	Cat. No.	Description
NCS-1	Schlieren source, normal and color, BH-6 lamp only, less pier, power supply or electrical control panel, with folding mirror and mount.	NS-1	Schlieren source, plain type with Pechan prism head, with BH-6 lamp only, with optical bench sub base, less pier, power supply or control panel.
NCS-1D	Schlieren source, as above, but dual source, with BH-6 & FX-12 lamps, less pier, power supplies or controls.	NS-1D	Schlieren source, plain type with Pechan prism head, with BH-6 & FX-12 lamps, local control and capacitor bank for FX-12, less capacitor power supply or BH-6 supply, less control panel.

SCHLIEREN SOURCES - PLAIN TYPE

PSS-1 Schlieren Source





PEK-75 Lamp Mounting

In its simplest form, a Schlieren source consists of a housing in which is mounted a suitable light source, a relay lens system, and an entrance aperture to the system.

High pressure mercury arc lamps, such as the General Electric BH-6, are commonly used as they have a high light level output (about 10 times that of an incandescent source) and the rectangular form of the emissive portion (approximately 1mm x 25mm) lends itself well for illuminating a slit.

Another very excellent source is the PEK-75 Xenon arc lamp which can be operated steady state or pulsed. While the arc length and width are quite small (.015"x.015") the lamp has the advantage that compressed air cooling is not required. Osram lamps of several types have also been used.

All sources using the above lamps are practically of identical construction and differ only in the rear cover and the provision for the lamp holder. The relay lens system, in a focusing mount, images the source on the entrance aperture and is usually of unity magnification and with an aperture ratio adequate to fill the collimating mirror.

Zirconium arc and incandescent sources find limited application and will be quoted upon request.

Cat.	Th.T -
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Description

Cat. No.

Description

PSS-1

Plain Schlieren source, BH-6 lamp holder, less lamp or power supply, with optical bench sub base.

PSS-X-75 As above but lamp holder for PEK-75 lamp, less lamp or power supply.

POWER SUPPLIES



PS-75 Power Supply





PS-1 D.C. Power Supply and Control Panel

The General Electric BH-6 Mercury Arc Lamp has found general acceptance as a source for Schlieren systems. The lamp provides an intense line source of illumination which can then be used with suitable optics to illuminate the entrance slit of the system.

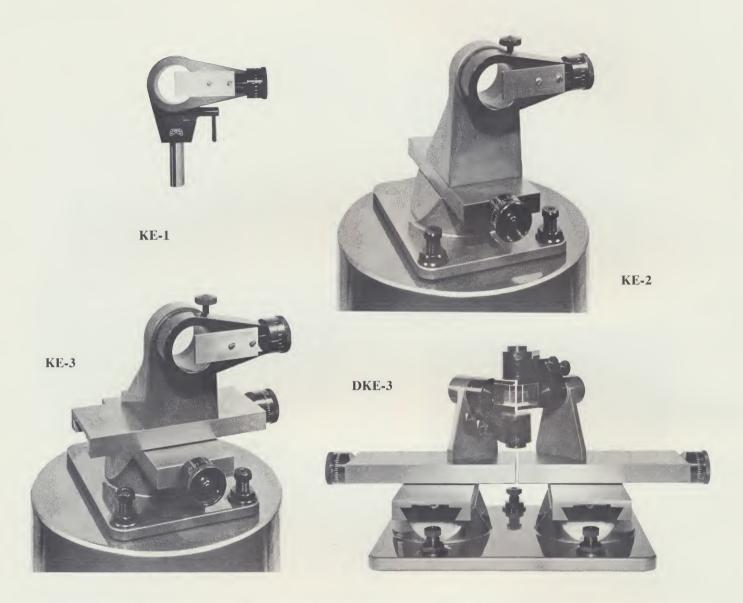
The power supply was specifically designed for the continuous D.C. operation of this lamp. The 220V, 60 cycle, 3 phase input to the power supply is rectified and suitably filtered and incorporates control circuits for the preheating of filaments and an electrically operated solenoid valve actuated by a pressure interlock so that lamp will shut off automatically if air pressure for lamp cooling is inadequate. The unit also has automatic polarity reversal of the D.C. output voltage each time the supply is energized so as to avoid mercury migration to one electrode.

In instances where the power supply will be used with a dual lamp Schlieren source, the power supply for the FX-12 Xenon arc pulse lamp is incorporated in the same unit. A 19" relay control panel is furnished with the supply or, when mounted in a pier, the control will be mounted on the pier door. The supply measures 15¾" wide, 175%" deep and 14¾" high. Weight 155 lbs.

The X-75 Xenon arc supply operates from 110V, 60 cycle, single phase line voltage and has electrical interlocks as required for use with Cat. No. PSS-X-75 Schlieren source. Housing measurements are 12" deep, 9" high, and 81/8" wide. Weight 35 lbs.

Cat. No.	Description	Cat. No.	Description
PS-1	Power supply for D.C. operation of BH-6 lamp, complete with interlocks, airline con-	PS-1-DX	Power supply as above with FX-12 supply housed in same unit.
	trols and control panel, 220V, 60 cycle, 3 phase input.	PS-75	Power supply for PEK-X75 lamp Schlieren source.

SCHLIEREN KNIFE EDGE UNITS



Three types of knife edge cut-off units for use in Schlieren systems are supplied.

In each type, the stainless steel knife edge, which is $1\frac{1}{4}$ " wide, can be rotated 360°. The jaw is driven by a micrometer screw with a travel of $1\frac{1}{8}$ ".

The post type is used in conjunction with a rider on an optical bench by the ¾" diameter x 4" long stainless steel mounting rod.

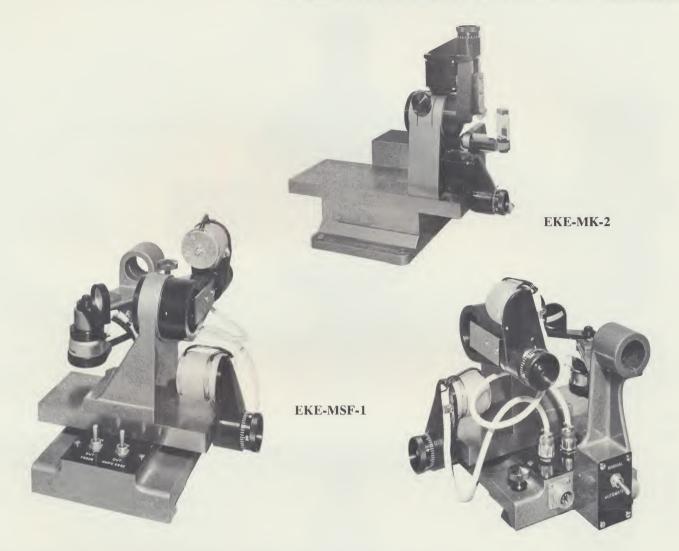
The axial type uses the same head assembly, but the unit is mounted on a micrometer slide with $3\frac{1}{8}$ " axial travel, and the coordinate base type has $3\frac{1}{8}$ " travel along and transverse to the optical axis.

Types KE-2 and KE-3 have a flanged cast base with leveling and mounting screws for use on a 12" column. Dial calibrations are to .001".

Type DKE-3 is a double knife edge unit consisting of a coordinate motion base with a head assembly for a sharp edge aluminized prism. The center of rotation for the prism in the horizontal and vertical planes is along and in the middle of the sharp edge of the prism. The unit is usually used with a single spherical mirror Schlieren system (double pass) wherein one prism directs the radiation to the mirror and the second forms a reflective knife edge.

Cat. No.	Description	Cat. No.	Description
KE-1	Knife edge, post type	KE-3	Knife edge, coordinate type
KE-2	Knife edge, axial type	DKE-3	Knife edge, double reflective type

ELECTRIC DRIVE KNIFE EDGES



In instances where it is desirable to have remote control of the knife edge assembly of a Schlieren system, we can supply such units with electric motor drives.

The electrical operational controls can be located in the console room and set of switches can also be provided on the unit for local operation. Each drive is constructed with an overrunning clutch so that the drive knobs can also be manually operated. Movement of the axial slide is .002"/sec. and on the knife edge the rate is .001"/sec.

An additional feature is an electrically operated "flip" mirror which intercepts the beam for a projection or closed circuit TV monitor. The mirror is normally in the beam and when set on automatic and energized, the swing of the arm out of the beam trips a switch which can then close the circuit to the operation of the camera. When switched to the manual position, the mirror can be locked out of the beam for camera focusing and adjustment.

A variation of the above arrangement is the reflective knife edge. The reflected component is directed by two additional mirrors to a closed circuit TV monitor or projection screen and has the distinct advantage that the Schlieren field can be continually monitored. As shown, it is arranged for horizontal position of the knife edge. While the head assembly can be rotated 90°, repositioning of the mirrors would be necessary. Generally such units are designed for a single knife edge orientation.

Cat. No.	Description	Cat. No.	Description
EKE-MSF-1	Electric drive knife edge, axial adjust- ment slide, optical bench mounting, with electromagnetic "flip" mirror and holder for projection lens, less lens.	EKE-MK-2	Electric drive knife edge, with reflective knife edge, mirror relay system and sub base for Kintel closed circuit TV (not furnished) folding mirror mount and mirror, flanged base mounting.

SLITS



Slits of two types are supplied, these being the precision bilateral and the four jaw independent drive.

The precision type slit is of kinematic bilateral form and all moving elements are mounted on hardened steel balls. The micrometer drum is calibrated to read 5 microns and the slit has a maximum opening of about 1½ mm. Jaw length is %" and a fishtail diaphragm is housed within the cover plate.

The slit is 3'' in diameter and the rear side terminates in a cylindrical section 1.600 diameter by 5/16'' long. Four holes are provided for mounting screws which are accessible when fishtail cover assembly is slipped off the slit body.

The four jaw independent drive slit is used in the BH-6 Color Source and each jaw is individually adjustable so that any specified spectral range and band pass width may be selected. Length of opening of slit adjusts intensity at image plane.

Cat. No. Description

PS-1 Precision Bilateral Slit

MJ-4 Four Jaw Independent Drive Slit

CONDENSER & RELAY SYSTEMS





Mounted relay systems designed to operate at unity magnification or other system conjugates are available. When requesting price quotation, indicate image-object plane separation, ratio and "f" number of system which the condenser must illuminate.

MICROMETER SLIDES



These micrometer slides are useful for many laboratory setups where an accurate adjustment or means of measuring is required.

The upper surface measures $3\frac{1}{2}$ " x $8\frac{1}{4}$ ", and the lower mounting surface has four 8/32 mounting holes spaced on $1\frac{1}{2}$ " x 3" centers. A precision ground thread stainless steel screw is anti-friction mounted and operates in a bronze nut. Gib is spring loaded. Axial travel is $3\frac{1}{8}$ " with a dial calibration of .001". Working surfaces are accurately ground.

Cat. No. MS-1

DescriptionMicrometer Slide

CASSEGRAIN SYSTEMS

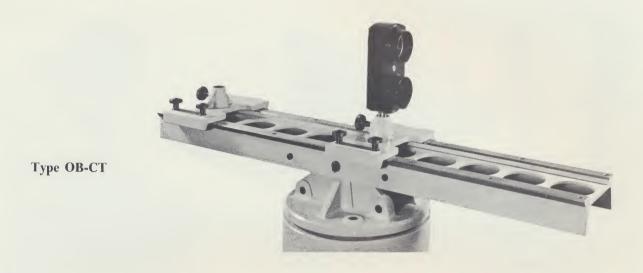


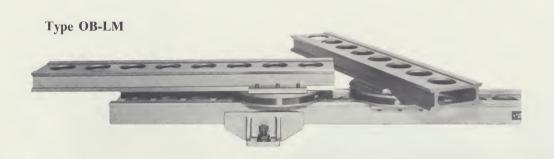
The photograph illustrates the general design of Cassegrain Systems of our manufacture.

In our design, the primary mirror is accurately optically centered and axially retained by a threaded retainer ring. The secondary is mounted by push-pull screws for "squaring on" and the mirror can be fixedly mounted or mounted on a non-rotating axially focusing assembly to establish accurate separation of the optical vertices and which can then be locked in position.

We will be pleased to quote your requirements for complete units, or the mechanical or optical components of such systems.

OPTICAL BENCHES & ACCESSORIES





Useful for general optical apparatus and test set-ups. Optical benches of our manufacture are steel weldments which have a 60° dovetail cross section and measure 65% across sharp edges. Reference surfaces are accurately planed and they can be supplied with an inserted scale calibrated in millimeters.

Several forms are available. In length from 12" to 36" they can be furnished with the illustrated central, angularly adjustable trunnion which can be mounted on a P-12 pier. For table mounting or across two or three piers, they are available in lengths up to 144". A double cross section as shown in the photograph can be also supplied and with the intermediate swivel coupling, the shorter section can be set at any position relative to the base optical bench.

Leg mounted optical benches are provided with leveling and mounting screws.

Cat. No.	Description		Cat. No.	Description	
OB-LM-36 OB-LM-48 OB-LM-60 OB-LM-72 OB-LM-96 OB-LM-120 OB-LM-144	Leg mounted optical bench	36" long 48" long 60" long 72" long 96" long 120" long 144" long	OB-CT-12 OB-CT-24 OB-CT-36 OB-DS-24 OB-SW-6 OB-RS-6 OB-RS-0	Central trunnion optical bench 24	
Note—For graduated type (max. length of 96"), add suffix "G"			OB-RM-6 OB-RM-12	Rider, plain machined top, 6" long Rider, plain machined top, 12" long	y S



Type TS-OB

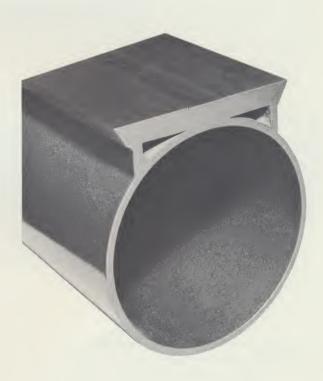
A recent addition to our line of optical benches is this series which uses seamless steel cylinder as the structural support element. This construction gives an optical bench of high load carrying capacity with minimum of flexural and torsional deflections. The dovetail cross section is identical to that of the standard optical benches. However, the top surface is flat and has a central groove in which can be inserted a moveable or fixed measuring scale.

The tubular section can be used to house a collimator system and, with a system of end reflectors, very little additional space is required for a collimator of relatively long focal lengths.

This series is available as a standard catalog item up to 12 ft. lengths. Longer benches will be quoted upon request.

Cat. No.	Length	Cat. No.	Length
TS-OB-6	72′′	TS-OB-10	120′′
TS-OB-8	96"	TS-OB-12	144′′





SELF CENTERING CHUCKS

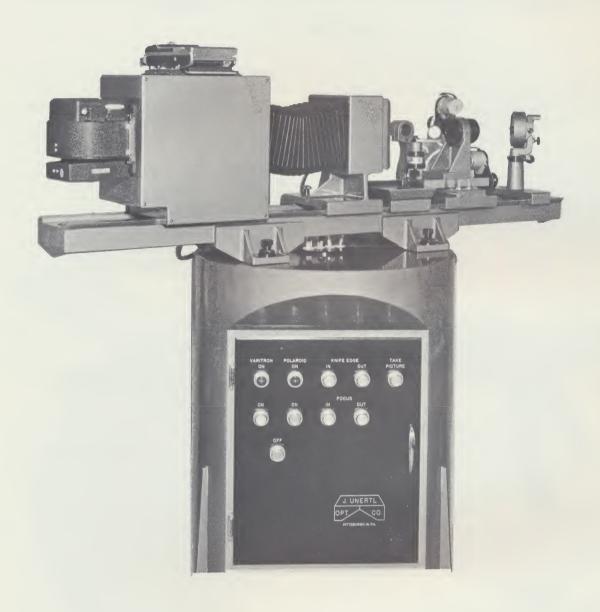
The above chuck assembly fits our standard optical bench and is accurately self-centering with a minimum capacity of 34" and a maximum of 8" diameter. The nylon clamp fingers are reversible and fit on fixed steel screws so that by rotation the optical element being held can be accurately "squared on" the optical axis.

While originally designed for use in our own shops for the testing of reflective optical systems, users have found many additional applications for routine optical testing and prototype system evaluation.

Cat. No. Description

SCC-8-OB Self-centering chuck, 8" capacity, optical bench base.

SCHLIEREN RECORDING SYSTEMS



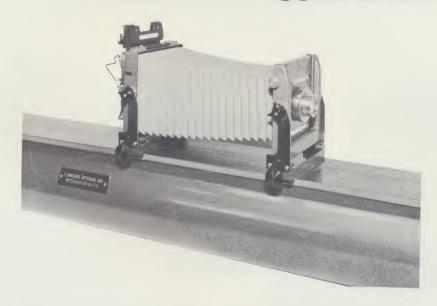
The receiver of a Schlieren system is probably the most variable component of any installation, and its selection and design must be made on the basis of the requirements of the specific application.

Irrespective of the mode of recording used, it is necessary that a provision be made so that the alignment and performance of the system can be visually established. This may simply be a ground glass in the camera back or an auxiliary projection or TV monitor system. The photographic recording can be done by still cameras using Land-Polaroid or normal films, pulse cameras or high speed motion picture cameras of various frame sizes and manufacture. These can be used individually or, if desired, several can be mounted in a single receiver with optical gating to permit selection.

The receiver illustrated can be locally or remotely operated for all functions except as required for the Polaroid back and the shutter speed settings. The shutter is of standard Compur design (T, B, & 1 to 1/200 sec.) but modified for electric operation. A solenoid system operates a beam deviating mirror so that recording can be done either on a Land-Polaroid back or with a 70MM Varitron pulse camera magazine.

We will be pleased to receive your specifications.

SCHLIEREN CAMERA



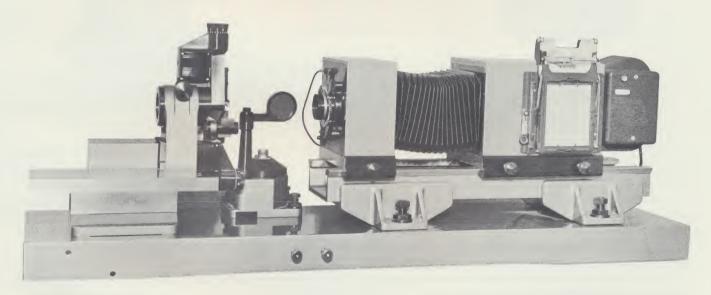
In many instances, particularly where the Schlieren effect is continuous, a still camera may be used for photographic recording.

We supply an all-metal bellows type 4" x 5" View Camera which has been specifically adapted to fit our standard dovetail cross section optical bench. Normally a short optical bench is mounted behind the knife edge and the camera then can serve the dual function of the photographing means and also as the projection screen on the ground glass of the camera back.

Long focal length objectives as required to form images of adequate size mounted in Compur, Rapax, or Alphax shutters are supplied. The metal lens boards (4" x 4") are interchangeable and enable use of a variety of lenses to cover various film formats.

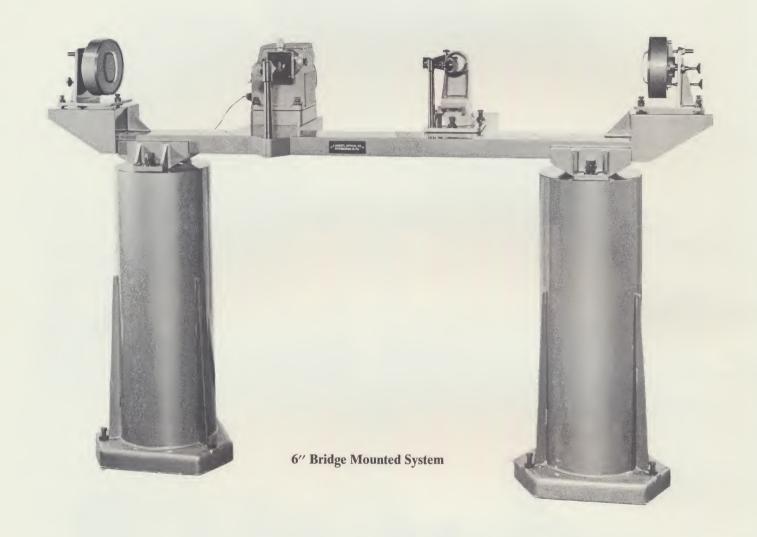
The revolving back of the camera can be used with 4" x 5" metal cut film holders, No. 120 or 220 roll film holders or 4" x 5" Polaroid cut film holders.

At any time desired, the entire camera can be removed from the optical bench and another camera substituted. Mounting bases matching the alternate camera to the system can be furnished.



Schlieren recording system with electric drive knife edge, using reflective knife edge for Kintel closed circuit TV monitor, electromagnetic "flip" mirror to high speed motion picture camera, electric drive shutter with 4" x 5" Polaroid and 70mm Beattie-Coleman camera backs.

PACKAGED SCHLIEREN SYSTEMS



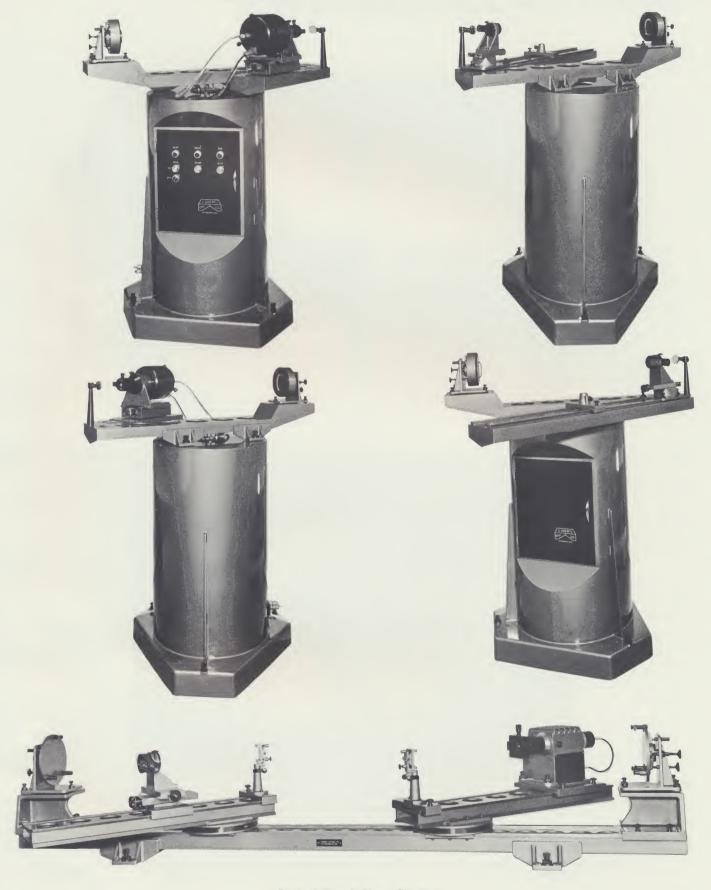
Complete Schlieren and Shadowgraph systems can be constructed by the proper selection of component parts as are listed in this catalog. However, it may be more feasible for a laboratory to purchase such an installation as a complete "package" and avoid considerable optical and engineering design.

In order that we may submit a quotation on such "packaged" systems, we have established the following procedure. A plan and elevation drawing outlining the space available for a system is submitted to us with a general description indicating the preferred locations of source and camera, size of analytic field, system sensitivity, type of source(s) and mode of recording. We then submit for evaluation drawings for the proposed installation. These drawings are generally not final but form a basis from which by additions, corrections, and modifications a final system is evolved. We do not make any charges for this service as we feel it to be of mutual interest to formulate a system which realizes the required end results.

Our catalog lists only the more standard items and in many instances, specialized system components which may or may not previously have been made can be used to great advantage.

We offer this service on systems of any size and invite your inquiries.

SPLIT BRIDGE SCHLIEREN SYSTEM



Optical Bench Type System

20" U.S. NAVAL ORDNANCE LABORATORY SCHLIEREN SYSTEM



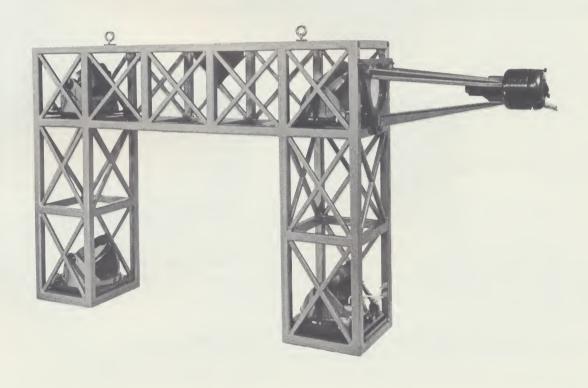


The above photographs illustrate a Schlieren System constructed for the U.S. Naval Ordnance Laboratory. White Oak, Silver Spring, Maryland. Each half of the system travels on rails as shown and the tubular elements can be angularly inclined to about 45°.

AUTOCOLLIMATING SHADOWGRAPH



10" MACH-ZEHNDER INTERFEROMETER



GRATING MOUNTING

This mounting will accommodate gratings up to 210mm diameter and has a base to optical axis height of 8" when the leveling and mounting screws are in the middle of the travel. A kinematic design permits the use of a number of backing plates with a single base and each grating with its backing plate may be individually zeroed.

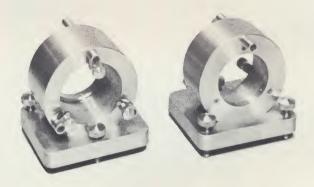
The grating is held by three retaining clips and on the rear side of the backing disc is located a ring having mounted therein three fine pitch threaded studs with spherical heads, and a set of tangent screws which rotate the backing disc relative to the ring. Adjustment of the three spherical studs permits focusing and angular alignment and the tangent screws align the ruling parallel to the slit. After initial setup, the locking bolts may be tightened.



The rotary base is available in various ratios and dial calibrations or with electric drive for scanning systems. On the rotary table is mounted a shelf having three studs with ground female "Vees" which kinematically locate the grating backing disc assembly. A single spherically seated thumbscrew couples the two units.

Cat.	No.	Description	Cat. No.	Description
		Grating Mount, complete Grating Mount, base assembly, 60:1 ratio	GM-60P	Grating Mount, plate assembly for holding grating, with reference studs and tangent drive, (specify grating size)

FABRY-PEROT INTERFEROMETERS



Mountings illustrated are for interferometers using 2" diameter plates. Entire assembly is made from stainless steel and an Invar plate separator is used. Flexure springs provide for the final alignment of the interference faces. The type shown is for a fixed single spacer. Designs are available for mountings which can accommodate fixed spacers of various dimensions.

Cat. No.

Description

FP-2

Fabry-Perot Interferometer Mounting, for 2" plates, less plates, with one fixed spacer, length to be specified.

OPTICAL TESTING INSTRUMENTATION

Various forms of reflective and refractive collimators and optical testing apparatus can be furnished.

The unit shown is for the evaluation of high aperture ratio parabolic infrared reflective optics as are used on guidance and seeker systems. The system is based on the method of using the mirror under test as a collimator element and examining its performance at the focus of a second parabolic mirror of known quality and having a focal length of 10 to 15 times that of the mirror under test. Circle of confusion, surface regularity, astigmatism and various other optical properties can be easily ascertained. Elliptical mirrors can also be tested by using the source at the near focus and the knife edge testing at the conjugate long focus.

The collimator pictured consists of a short pier mounted optical bench with a 12" capacity universal face plate mirror mount and the illuminator. A Zirconium arc lamp in the lamp housing is used with a suitable relay lens system to illuminate the conjugate image of a short focal length microscope objective. The demagnification of the objective forms a point source and with adequate angular coverage to illuminate a mirror as fast as f/.3.





TRI-ORDINATE SLIDES

These slide assemblies were originally designed for a 16" Infra-Red Collimator system for the testing and evaluation of infrared photographic optics. Many have since been supplied where it was necessary to have available a means of accurate positioning or measurement in three ordinates. The vertical travel is 12" and upper slides each have a travel of 8". Dial readout in all ordinates is .001". Pier size is 16".

Photographs of available designs upon request.

Cat. No.	Description	Cat. No.	Description
TS-3A-P	Tri-ordinate slide, plain type	TS-1A-P	Pier with vertical axis assembly only
TS-3A-R	Tri-ordinate slide, rotary table top		

LIGHT PULSE GENERATOR



This instrument was devised at the Westinghouse Research Laboratories, Pittsburgh, Pennsylvania, by Messrs. M. Garbuny, T. P. Vogl and J. R. Hansen for the generation of very fast light pulses.

The method consists of surrounding a hexagonal mirror driven by a series wound motor by a corresponding number of stationary mirrors. A paper on this instrument was published in The Review of Scientific Instruments (Oct. 1957, p. 826) and full performance specifications were given.

Auxiliary reflective optics for the condenser and collimator can be furnished.

Cat. No.

Description

LPG-1

Light Pulse Generator

VIEWING AND ALIGNMENT TELESCOPES



Telescopes of many forms are standard production items which can be adapted for laboratory use for purposes of observation and alignment.

Short distance viewing telescopes, usable at distances as close as 12" and with magnifications of from 4X to 14X, are a modification of standard designs and have found wide acceptance in radiation laboratories.

A separate catalog is available on our standard line of telescopes and will be furnished upon request.

SCHLIEREN OPTICS

We manufacture optical elements of highest quality for mirrors, windows and lenses.

Schlieren mirrors are generally made from Pyrex blanks and can be furnished up to 60" diameter. We stock mirror blanks up to and including 24" diameter, and larger sizes are ordered as required. For single pass "Z" form and autocollimating systems which use a plane mirror, the reflecting surface is figured as a parabola. Single mirror autocollimating systems use mirrors figured to true spherical form. Figuring of the surfaces is done by using the Foucault test. Final acceptance for a parabolic mirror is generally done by testing against a perforated plane autocollimating mirror or with a master parabolic mirror. For the majority of applications, the reflecting face is worked to 1/10 wave green light accuracy. Tolerance on focal length is $\pm 1/2\%$. The periphery of a mirror is edged and the rear surface fine ground and accurately square with the optical axis. Reflecting face is evaporated aluminum with a protective overcoating of silicon monoxide.

Schlieren windows are generally made from shadowgraphed quality crown glass, although fused quartz, commercial quality resurfaced plate glass or Herculite can be supplied. Our facilities permit the production of windows having a maximum diagonal dimension of 66" and about 6" thick. Edging such as the normal right angle, right angle plus single or double bevel, or rabbet edge on straight and contoured surfaces can be produced. Surface accuracy and wedge angle tolerances are made in accordance with customer specifications. Windows can be furnished complete with metallic mountings using a variety of bonding or gasketing materials.

MIRRORS, LENSES & PRISMS

An endless variety of mirrors, lenses and prisms are supplied, made from glass, Pyrex, fused silica, crystal quartz, synthetic crystals and metals. Large stocks of raw materials are stocked so as to reduce lead time. Excellent facilities within our establishment enable the precise testing of optical surfaces and systems and our efforts are directed toward the production of a superior product. Particular attention should be called to our ability for the manufacture of aspheric surfaces and high precision interferometric optics. Photographic specialty optics, mounted or unmounted, are available in variety of designs.

Traditionally, every optical firm extolls its abilities as given above but it must be realized that by far the greatest volume of optical components or systems are of rather nominal qualities. It is well to bear in mind that over specification is expensive and more often than not, a degree of precision that is totally unnecessary for a purpose accomplishes nothing but to raise the price. If the user is certain of his requirements, he should so specify and we assure our compliance with the specification. However, if a question exists, a clarification of the end use will probably enable us to offer a recommendation and more often than not, an economic saving.

CONCLUSION

Our catalog will serve to give an indication of the more general types of apparatus which we are prepared to furnish. It is only meant to be representative and certainly does not offer a complete insight to our products or capabilities.

Many extremely interesting and useful types of instrumentation are produced under contract with the U. S. Government, research laboratories and industrial concerns and are of such nature that they currently may not be divulged.

Our firm is interested in only the highest quality, and our staff will endeavor to fulfill your demands for optical, mechanical and electronic instrumentation.

> JOHN UNERTL OPTICAL CO. 3551-55 East Street Pittsburgh, Pa. 15214

Terms

ALL PRICES QUOTED ON REQUEST

The specifications contained herein were in effect at the time this literature was approved for printing. The John Unertl Optical Company, whose policy is one of continuous improvement, reserves the right, however, to change specifications or design at any time without notice and without incurring obligations.

Our products are guaranteed optically and mechanically to meet performance specifications.